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THE VETERINARY JOURNAL

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APRIL, 1936

Editorial

SOME INTERESTING ASPECTS OF HORSE BREEDING.

IN this issue we publish a contribution from Emeritus Professor W. L. Williams, which should be read carefully by those whose work brings them into direct contact with the breeding of horses. An article from one who has had the clinical experience of Professor Williams must command our fullest respect, even though he may make statements which seem opposed to those which we have been taught and which, by common belief, we have come to look upon as "sacrosanct," as he himself states. Admittedly, American horse-breeding conditions are not exactly parallel to those which exist in Britain. In this country we are probably, in normal years, favoured by a better climate, and possibly British horse-breeding records are somewhat better than those quoted in the paper, but we have experienced bad years, and we are likely to do so again in future.

Practitioners who are familiar with the breeding histories of mares which have ultimately become barren through the incidence of one or other of the many reproductive diseases, will be fully able to agree with Professor Williams when he says that any considerable extension of the normal duration of pregnancy should be looked upon as indicating reproductive abnormality in the mare. If

more owners could be persuaded to keep careful records of the duration of gestation in their mares and would make these available for study, there is little doubt that many mares could be recognised as requiring examination and treatment earlier than they are at present. It is slowly becoming more and more fully recognised that a fundamental principle of reproduction, which tends to be neglected by a majority of owners, is that very much of the vigour, subsequent health and success of the offspring depends directly upon the quality of the nutrition during intra-uterine life. The mare with some organic or other abnormality of the uterus may still be capable of conception, but cannot provide the fœtus with the necessary adequate nutriment for its best development. Consequently, a longer period of intra-uterine life must elapse, or the young animal is born weakly or under-developed. Veterinary practitioners can render much-needed assistance to the animal-owning community by advising better conditions for all animals during pregnancy, and by strongly condemning the all too common attitude of the man who thinks the only two important phenomena involved in successful reproduction are a satisfactory mating and parturition. Far more attention must be paid to intra-uterine life and to maternal nutrition if the best foundations are to be laid for the success of the offspring, whether it be a thoroughbred foal, a kitten or a human child.

It seems very desirable that one other aspect of Professor Williams' paper should be further emphasised. His terminal remarks referring to the desirability of a more extended use of sperm examination as an indication of the fertility of a sire are well worth careful contemplation. The full techniques presently available may not be within the scope of every practitioner, but the collection of a sample of sperm and the preparation of a stained smear should offer no insuperable difficulty, and even comparatively simple preparations yield an immense amount of valuable information to those who take the necessary trouble.

We commend this article, and others on the same and allied subjects from Professor Williams, to those whose work brings them into close contact with the many problems of breeding, as being well worthy of careful thought and consideration.

General Articles

OBSERVATIONS UPON SOME ASPECTS OF HORSE BREEDING.

By W. L. WILLIAMS.

Emeritus Professor of Veterinary Surgery and Obstetrics, Cornell University, Ithaca, U.S.A.

THROUGH the courtesy and hearty co-operation of Professor M. W. Harper, of the New York State College of Agriculture, at Cornell University, I have enjoyed the privilege of a study of the records of the college stud from 1910 to 1931 inclusive, with the foaling records of 1932. The records comprise a total of eighty-six mares which were served one or more times. Nine stallions and one male ass each served five or more mares. The study reveals certain elements of interest in the hygiene of horse breeding which apparently justify publication.

The Breeding Efficiency of Sires.

The stud records do not enable me to definitely fix the comparative fertility of the groups of mares bred to the different sires. So far as is known, the fertility of mares was approximately alike in each group. A study of the table shows

TABLE I.—THE BREEDING EFFICIENCY OF TEN PRINCIPAL SIRES.

Serial Number	Years in stud	Number of mares	Number of services	Number of conceptions	Percentage of conceptions	Viable foals	Percentage of pregnancies resulting in viable foals	Aborts	Non-viable foals	Total percentage of aborts and non-viable foals	Duration of pregnancies
1	1910–14	13	68	17	25.0	14	82.4	—	3	17.0	339.6
2	1910–17	6	27	12	44.4	9	75.0	1	2	25.0	334.9
3	1012–19	35	200	59	29.5	48	81.4	2	9	18.6	330.0
4	1917–18	5	18	2	11.1	1	50.0	—	1	50.0	330.2
5	1919–23	29	133	48	36.1	46	95.8	—	2	4.2	330.0
6	1923–25	13	33	14	42.2	8	57.1	—	6	42.9	330.2
7	1923–28	15	75	15	20.0	9	60.0	—	6	40.0	335·1
8	1925	14	17	8	47.1	7	87.5	—	1	12.5	331.1
9	1926–7	6	15	3	33.3	1	33.3	—	2	66.7	350.8
10	1926–31	19	84	45	53.6	33	73.3	1	11	26.7	339.6

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a wide variation in the ratio of conceptions to the number of services, being lowest in four (11.1 per cent.), and highest in ten (53.6 per cent.). The abortion rate is comparatively low. The records indicate that in two or three cases abortion was suspected, but not authentically determined; in these instances the mares had been supposed to be pregnant, but proved empty. If they aborted, the fœtus was not discovered, although the conditions were unusually favourable for observing abortions. In the last column but one, that dealing with non-viable foals, there are included stillbirths, foals which died immediately following birth, or perished during delivery in dystocia, and those foals which died young, within, say, thirty days post-natal.

The cause of the non-viability of foals so classified is not uniformly determinable. For example, it was believed that a mare killed her foal, but that is not positively known. Even were that known, its significance would not be clear. Not infrequently a parturient animal disowns or destroys diseased young; or the mother may be mentally deranged because of genital disease, and do away with young; or the killing of the young may be purely accidental, whereupon classing the young animal as non-viable becomes misleading. The column, therefore, simply means that the foals so listed did not live, and that they did not necessarily all succumb to diseases connected with reproduction, although certainly a majority of the deaths were attributable to that cause.

The Influence of the Age of Fillies at First Conception upon their Value as Breeders.

There have been frequent expressions of opinion regarding the best age at which a filly may be first bred, but not many data are available as a basis for discussion and conclusion. There exists a technical belief that a young domestic mammal should have attained a near approach to adult size prior to the production of young, but this hypothesis is frequently disregarded in the breeding of fillies and nonchalantly flouted in the breeding of dairy heifers. Several factors step in to becloud and modify the question. Thoroughbred fillies are largely placed in training and their utmost strength devoted to the development of speed. This depresses reproductive power, and their rate of conception is low for a period after withdrawal from training. In this stud, consisting almost entirely of Percherons and Belgians, the training factor was absent. The studies of the data fail to indicate the presence of important elements in nutrition or growth which might interfere with normal development. Naturally, they were well fed and maturity hastened. As a group they should probably be regarded as highly favourable for early breeding. Table I needs to be studied cautiously. It is fair to assume that those fillies bred not later than 2.5 years comprised the largest and most vigorous. 43.8 per cent. of them failed and automatically very largely passed into the second group, 2.6 to 3 years, and so on down to the final group, where it may be properly surmised the fertility was low. The numbers of animals are too small to justify far-reaching conclusions. It is interesting,

nevertheless, to note that the best showing by far is made by those fillies conceiving for the first time at 3 to 3.5 years. The percentage of pregnancies ending in viable foals is the highest, and the duration of gestation lowest. Von Oettingen[1] states that fillies regularly carry their foals considerably longer than pluriparæ. In this stud the average duration of gestation in 333 days, while for fillies it is 337 days, four days above the average for the stud, or five days higher than for pluriparæ. Van Oettingen attributes this longer duration of gestation to a lower nutritive supply in first pregnancy. The foals weigh less.

TABLE II.—THE AGE OF THE FILLY AT FIRST CONCEPTION COMPARED WITH THE ULTIMATE BREEDING EFFICIENCY.

Age at first conception	Number bred	Number conceived	Percent. conceived	Viable foals	Percent. viable foals	Duration of first gestation	Total services to mares in column 3	Total viable foals	Viable foals per mare	Aborts and non-viable young		
										First pregnancy	Later pregnancies	Percent. aborts and non-viable foals
Not over 2.5 years,	16	9	56.2	5	55.5	334.5	112	37	4.1	4	3	21.3
2.6 to 3 years ...	24	13	54.2	9	69.2	341.2	94	31	2.4	4	7	26.2
3 to 3.5 years ...	15	11	73.3	10	90.9	334.0	70	30	2.0	1	6	18.9
Over 3.5 years ...	5	5	100.0	3	60.0	338.7	26	7	1.4	2	3	41.7

There is an interesting variation in observations upon the duration of gestation in fillies and heifers; in the former the duration of gestation is regularly longer, in the latter, shorter, than in pluriparæ. This, however, is in accord with the general observation that abbreviated gestation is common in the cow and rare in the mare, while prolonged gestation is common in the mare and uncommon in the cow. But a careful study of this apparent contradiction seems to show that abbreviated and prolonged gestation indicates in both species subnormal health in both mother and young. The average number of viable foals per mare seems confusing. The conclusion may be invited that the earlier a filly is bred the more foals she will ultimately produce. This has not been studied in detail, but the other data in Table II deny this, and such search as has been made does not seem to justify the conclusion.

In Table III an effort is made to indicate or suggest the influence of the epoch in the breeding life of the animal at which conception occurs. The first line of Table III, primipara, is apparently in conflict numerically with Table II. Certain data were not available for II, *e.g.*, a few females which were "lot bred," etc.

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TABLE III.—THE INFLUENCE OF TIME OF CONCEPTION UPON REPRODUCTIVE VIGOUR.

Time of service	Number of services	Number of conceptions	Percentage of conceptions	Aborted or died early	Percentage of non-viable young	Viable foals	Percentage of viable foals	Duration of gestation, viable foals	Weight	Daily weight increment
Primiparæ	107	55	51.4	19	34.5	36	65.5	335.2	122.8	0.3663
Conceived at 6–15 days post-partum ...	148	62	41.9	12	19.4	50	80.6	333.3	126.4	0.3792
Conceived at 16–99 days post-partum ...	109	51	46.8	5	9.8	46	90.2	328.2	133.6	0.4071
Conceived at 100 days or later	226	59	26.1	10	16.9	49	83.1	329.9	123.3	0.3737

In horse breeding there is a tradition commonly held as sacrosanct, that the best results are attained by breeding a pluriparous mare at the first œstrum post-partum. Unlike the cow, the corpus luteum of pregnancy in the mare atrophies and disappears at about mid-term and thus exerts no known restraining influence upon ovulation immediately following foaling. The first œstrum appears anywhere from the sixth to the fifteenth, usually at the eighth to ninth day. This allows only a very brief period for stabilisation of the reproductive system. The method of placentation in the mare involves, when the afterbirth comes away, the complete denudation of the entire uterus of its protective layer of epithelium, which must be restored. The uterus must contract to a very insignificant fraction of its size during pregnancy. In 1926[2] I ventured to question the sanctity of the tradition that the best time to breed a mare is at the first œstrum post-partum, and submitted the following regarding observations in a comparatively healthy thoroughbred stud :—

" From one large stud with accurate breeding records, involving 120 breeding years (or mare years) of mares bred on the ninth day, I was able to glean the following data : There conceived on the ninth day, 36 : 30 per cent. ; at later breedings the same year, 49 : 40.8 per cent. ; failed to conceive the same season, 35 : 29.2 per cent. . . . The 36 mares which conceived on the ninth day produced 32 viable foals (88.9 per cent.) ; abortions and mortally ill foals, 4 (11.1 per cent.). The 49 mares which failed on the ninth day but conceived later, that year produced viable foals, 47 (95.9 per cent.) ; abortions and mortally ill foals, 2 (4.1 per cent.)."

Subsequent to this public statement other observers have confirmed the general principles involved. In Table III the ratio of conceptions from breedings in first œstrum is definitely lower than among those which conceived in later

œstral periods, and the ratio of non-viable young in first œstrum conceptions is double that observed in those occurring at from 16 to 99 days. Those mares becoming pregnant at 100 or more days post-partum naturally show a low ratio of conception per service, because they include a large percentage of sterile animals. A few of these were held out of breeding in order to bring foaling at a more desirable season. If these were excluded it would lower the rate of conception and advance the percentage of non-viable young. It is equally significant that the most healthy individuals conceived on the ninth day, and that the least healthful failed at that time, but conceived at 16 to 99 days post-partum. Hence it follows that those mares in the poorest reproductive health, aided by an increased sexual rest interval before again becoming pregnant, did far better than their healthier mates which became pregnant on the ninth day before the reproductive system had become adequately readjusted and repaired.

Passing to the average duration of gestation and weight of viable foals, some highly interesting figures appear. Von Oettingen[1] has stated: "In mares which foal normally, the duration of gestation commonly grows shorter in the course of years. Accordingly, primiparæ usually show a longer duration of pregnancy than do pluriparæ. After a gestation period of but 315 to 320 days, many Trakehnen foals have later become excellent brood mares, head sires and public stallions. On the contrary, it has been the experience in the Trakehnen stud that foals carried over eleven months (335 days) rarely, those carried over 346 days almost never, rank high. . . . For the completion of pregnancy and the production of mature foals, the primipara requires a few more days or pregnancy than for subsequent births, and many fillies show a tendency to fail to carry their foals to full term. Nearly all excellent firstlings known to me (*e.g.*, those which have become outstanding brood mares, head sires and public stallions) show gestation periods five to ten days greater than other excellent sires and brood mares." Then follows a list of the twenty-one most outstanding Trakehnen sires, with their durations of gestation. Sixteen of these were bred in the Trakehnen stud. The better eight averaged 326.87 days *in utero*; the poorer eight, 332.62 days. The data in Tables III and IV coincide with the views of von Oettingen and at the same time bring out other interesting facts. It is shown in III that the duration of gestation is modified by the post-partum sexual rest allowed. The conceptions occurring during first œstrum were carried five days longer than pregnancies beginning at 16 to 99 days post-partum. At the same time it is shown that the birth weight was greater by 7 lb. in those foals which were carried five days less. Hence it is shown that in this stud, omitting for the moment the primiparæ, the duration of gestation is longest in the ninth day conceptions, and shortest for the pregnancies beginning between 16 and 99 days, while the flotsam and jetsam of the stud, mixed with a few fertile mares held out of breeding for tactical reasons, which have become pregnant at not less than 100 days post-partum, occupy a middle ground. Perhaps the most interesting showing is in the final column, the daily weight increment, expressed in decimals of a pound.

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Animal husbandmen generally admit, at least technically, the desirability of the maintenance of vigorous growth of the extrauterine young animals, but have paid scant heed to the value of optimum growth *in utero* and of the factors which determine the rate of fœtal growth. In extrauterine life the rate is dependent upon the nutriment available and the power of the individual to assimilate it. The intrauterine animal is dependent upon the two mentioned factors as they affect the pregnant female, but in addition the pregnant uterus needs be healthy in order to transmit nutriment to the fœtus, and the latter must be in a state of health to profitably use it. It may, therefore, be reasoned that if the uterus is diseased, or remains in a state of fatigue due to the prior pregnancy, the fœtus cannot benefit in the highest degree from the nutriment offered.

TABLE IV.—THE BREEDING EFFICIENCY OF MARES ACCORDING TO THE DURATION OF TIME THEY WERE CARRIED IN UTERO.

Duration of gestation of mares	Number of mares	Number of services	Total pregnancies	Viable foals	Percent. viable foals	Copulations per viable foal	Average foals per mare	Aborts and non-viable foals	Percent. of non-viable young
Not over 320 days	20	159	58	48	82.8	3.3	2.4	10	17.2
321–339 days	25	152	71	57	80.3	2.7	2.3	14	19.7
Over 339 days	7	69	21	14	66.7	4.9	2.0	7	33.3

The farther the question is pursued, the more interesting it becomes. Schmaltz[3] says: "If we accept 80 lb. as the birth weight of the calf and foal, then the foal acquires one-half this weight in the ninth month, that is, in the last quarter of gestation. . . . In the first half of pregnancy the foal reaches a weight of 8 to 10 lb., or about one-tenth of the weight at birth." Hence the daily weight increment advances by leaps and bounds as birth approaches. Therefore a foal carried 350 to 360 days should, if thoroughly healthy, grow with phenomenal rapidity during the last days of intrauterine life. But the fœtus carried over time grows far more slowly. So the fœtus conceived at 16 to 99 days post-partum, and with a gestation period of 328.2 days, is 7 lb. heavier at birth than the foal conceived in first œstrum, although the latter has been carried five days longer. Somewhere, perhaps varying with breed and environment, between 320 and 335 days is an optimum duration of pregnancy in which the fœtus attains the maximum of vigor and growth.

The mare is the most definitely uniparous among domestic mammals, and twin ovulation is distinctly pathological or teratological. During the period covered there have been five twin pregnancies. Nine of the twins were aborted

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or died early, leaving as the sole survivor one undersized mule. Two of the five were conceived in first œstrum, representing 3.2 per cent. of the first œstrum pregnancies. One was conceived at 94 days, representing 1.96 per cent. of group. The other two came in the conceptions occurring at 100 days or later and represent 3.4 per cent. of the group.

Following still yet another step the lead of von Oettingen, an effort is made to group together the brood mares bred and retained in the stud for breeding purposes, the duration of the pregnancy of which is known. These data are set forth in Table IV, and include 52 mares. The data admittedly invite the criticism that they are too limited to justify important conclusions. They coincide however with the observations of von Oettingen, and pending the availability of adequate data may well cause attention to be directed upon these questions.

Certain points which have been brought out deserve consideration. In Table I a wide variation in the fertility of sires and the viability of their progeny is very marked. Sire 4 makes the worst showing in the group, but his service was too limited to be of great significance in itself. The worst record with any significance is that of sire 7, with an extremely low rate of recognised conception and a high rate of non-viable young. Further study of the records reveals the interesting fact that of the fifteen separate mares bred to sire 7, only five of them were subsequently bred to other stallions, three to sire 9, and two to a sire lightly used and not included in Table 1. Neither of the five conceived from these later breedings. His yearly stud history is interesting.

1922	7 services	1 conception	1 viable foal	– abortions	– non-viable foals
1923	14 services	6 conceptions	2 viable foals	—	4 non-viable foals
1924	18 services	2 conceptions	2 viable foals	—	—
1925	14 services	5 conceptions	3 viable foals	1 abortion	1 non-viable foal
1926	8 services	—	—	—	—
1927	2 services	—	—	—	—
1928	2 services	1 conception	1 viable foal	—	—
1929	3 services	—	—	—	—
1930	6 services	—	—	—	—
1931	1 service	—	—	—	—

Sire 9 broke down completely early in 1927. The ampullæ, or glandular segment of the vasa deferentia, were greatly swollen and highly sensitive to digital pressure per rectum. The epididymes and seminal vesicles were clinically inflamed. His breeding condition appearing hopeless, he was castrated. While it must be assumed that some form of infection was at work, it was not technically identified. Neither is there evidence that sire 7 carried any form of dangerous infection. One of the six mares bred to No. 9 died shortly after the expulsion of a dead foal. Throughout the history of the stud there is no record of outbreak of a

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highly infectious reproductive malady. Presumably pathogenic organisms have been present in all abortions and most non-viable foals, but there is no evidence of the presence of an infection highly dangerous to healthy contact animals.

By what means may losses such as those recorded for sires 7 and 9 be avoided or ameliorated? As early as 1923[4] I had taken the stand that infertile males ejaculated spermatozoa abnormal in their morphology. Knowledge in this field has been greatly advanced during the intervening years through the studies of a very small number of workers, the most notable contribution of recent date being by Lagerlöf,[5] who has clearly shown that the fertility of bulls may be reliably shown by a careful examination of fixed, stained spermatozoa. It has been definitely established beyond contradiction that in the vast majority of cases the fertility of stallions and other males may be authentically determined by an examination of the spermatozoa; if there are many spermatozoa of abnormal morphology, the stallion is sterile or of low fertility. This does not indicate that the stallion harbours a dangerous contagious disease, but that if the sperm cell effecting conception is morphologically imperfect, the resulting embryo will be weak, will develop slowly (in mare), and will invite invasion of the uterus by bacteria not highly dangerous to a healthy embryo in a fundamentally healthy uterus. An accurate study of stained spermatozoa from stallions 7 and 9 would have automatically excluded them from stud service immediately. No. 7 was a purchased sire, and by formal agreement or by inference was warranted fertile. Technically he was fertile, since he did impregnate some of his mares; practically he caused a very serious loss in the stud. The warranty was legal and vicious. The purchaser of a stallion may readily, at nominal cost, have a scientific examination made of his semen, which is far more valuable to the buyer than any written warranty which the seller may be able to write. When an established sire shows signs of wavering in his fertility, a reliable check can quickly be made by the same means.

Tables III and IV present facts which should cause intelligent breeders to study their methods of breeding, especially the breeding of mares in first œstrum, with very great care. Tradition definitely approves, but the facts suggest that in numerous instances tradition is misleading. That many mares breed quite well at the first œstrum does not alone show that the foal will be better or as good as would have been the case had the breeding been delayed until the second period. The field offers abundant opportunity for disagreement, but it does seem to merit careful study.

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THE VALUE OF THE EYE-REFLEX IN ANIMALS SUBMITTED TO THE SO-CALLED ELECTRICAL STUNNING.

By J. ROOS and S. KOOPMANS.

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In an earlier paper in this journal (1934), on the so-called electrical stunning of animals, it was contended that absence of the eyelid reflex was of less value in judging the condition of the central nervous system in animals that are submitted to the electric current in order to stun them than was generally supposed by investigators and meat hygienists. Many of them concluded that animals treated in this way were stunned because the reflex was lacking; and since the eyelid reflex was immediately abolished consciousness was supposed to be lost immediately the current passed.

On page 242 of our previous paper it was said that it is clear that the eyelid reflex, *i.e.*, closure of the eyelids after the conjunctiva (or the cornea) is touched, is only possible provided that the eyelids are free to react. And since the eyelids are brought into tonic spasms as soon as the circuit is closed, it is to be expected that the reflex is in this way prevented. For this reason a negative eyelid reflex was said to be of far less importance in determining the state of the central nervous system in animals subjected to the electric current than in animals under narcosis.

A further series of experiments have since been performed which confirm these views. These will be described here. The object of these experiments was to analyse the effect of the electric current as regards its action on the eyelids, when it is applied for the purpose of stunning the animals.

As is known, the eyelid reflex consists of a movement of the eyelids, especially the upper lid, by which the palpebral fissure is closed completely or partially. This is brought about by excitation of the cornea, the conjunctiva or the retina. The reflex is elicited in a most simple way by touching the cornea or the conjunctiva. As this is the method of stimulation generally employed for the purpose under discussion, it was also employed in our experiments.

Obviously the integrity of the reflex-path (ophthalmic nerve, Gasserian ganglion, metencephalon, myelencephalon, facial nucleus, facial nerve) as well as the receptors and the effector, is indispensable for the production of the reflex. If one of the links of this chain is defective the reflex is abolished. A solution of cocaine, *e.g.*, inhibits the reflex by paralysing the receptor field of the ophthalmic nerve in the cornea and at the conjunctiva. The reflex centres can be put out of action by chemical narcotics and the degree of narcosis can be checked by the eyelid reflex, as it has been shown by many experiments that narcosis of the cortex and its connections with lower subcortical centres precedes

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that of the eyelid reflex centres. When, therefore, the eyelid reflex is abolished by narcosis, one may be sure that the functional activity of the cortical cells was already removed beforehand.

If it is intended to use the reflex to test the activity of the centres, one must be certain of the integrity of the other components of the arc. So the question to be answered here is this: Are we warranted in accepting such an integrity concerning the effector end organ, the m. orbicularis palpebrarum, in animals submitted to the electric current? The reader will remember that in order to stun the animal its skull is placed bilaterally between two electrodes, which have a surface area for large animals, such as the pig, of 35 square centimetres. The electrodes, combined as a forceps, are a part of the so-called electrolethaler, the application of which has already been described. It will be sufficient to repeat here that tonic and clonic contractions of the skeletal muscles are the most prominent symptoms and that the muscles near the electrodes where the density of the current is greatest, consequently the muscles of the head and neck, are the ones most violently and directly affected.

In the experiments to be discussed the eyelids have been brought into a state of contraction or spasm without affecting the functions of the other parts of the reflex-arc; and the question to be answered was in how far the eyelid reflex was influenced by this condition. The eyelids have been acted upon:—

(*a*) By stimulating the cervical sympathetic fibres by which the smooth-muscle fibres of the eyelid are thrown into contraction;

(*b*) By stimulating the eyelid muscles directly; and

(*c*) By applying (*a*) and (*b*) simultaneously.

(1) Stimulation of the Cervical Sympathetic Nerve.

After one of the branches of the cervical sympathetic had been exposed in the narcotised cat it was cut, and the electrode of Samojloff, insulated carefully from the other tissues, was placed at its peripheral end. The skin was then sutured. By insulated wires the electrodes were connected with the secondaries of an induction coil. The primary coil was fed by a current of 22 volts A.C. or by a current of 10 volts D.C., the latter in combination with an interruptor.

After the animal had recovered from the narcosis, the nerve was stimulated by Faradic shocks and the signs of sympathetic stimulation of the eye, as evidenced by contraction of the smooth-muscle fibres of the eye, the orbit and the eyelids, were observed; the opening of the eyelids increased, the pupils became dilated, protrusion of the bulbs occurred and the nictating membrane was retracted. These symptoms also characterised the excitatory effects caused by the electrolethaler. They have already been described.

The movement of the upper eyelid was recorded by connecting it, by means of a thin wire, with a light and sensitive lever which wrote on a kymograph. As the animal was placed in the ventral position the wire was drawn downwards

by closure of the eyelids, and in this way an upward deflection of the lever was recorded. Opening of the eyelids gave a downward tracing in the curve. The movement of the eyelid was magnified by the lever, about six times.

The conjunctiva or the cornea was excited by touching it with a sound or by blowing a stream of air against it through a narrow glass tube, which was placed at a small distance in front of it. When the air was allowed to pass from the reservoir, where it was kept under pressure, to the glass tube, a signal was automatically given by which this moment was recorded. If a tactile stimulus was given the moment was recorded by an electric signal.

In Fig. 1 the results of an experiment are illustrated. As soon as excitation of the cervical sympathetic nerve begins, the curve falls in consequence of the

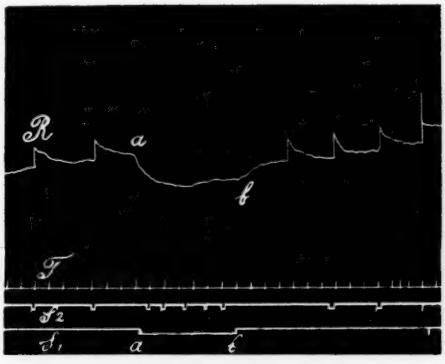

FIG. 1.—Eyelid-reflex is negative during the time that the cervical sympathetic nerve is excited. S_1 = signal for excitation of the nerve: the nerve is stimulated from *a* to *b*; S_2 = signal for excitation of the cornea by a stream of air blown against it; T = time in seconds; R = movement of the upper eyelid. The eyelid is raised during excitation of the sympathetic nerve, and after excitation it returns to its initial position.

fact that the upper eyelid is raised (point *a*), and this downward deflection i. maintained up to the moment when excitation is discontinued (point *b*). From this point the curve rises gradually, and after three or four seconds the original position is again reached. During the period of excitation the eyelid reflex is negative. About three seconds after excitation is terminated a spontaneous movement of the eyelid takes place, and after this the reflex is again elicitable. Two normal reflexes are produced before the sympathetic nerve is excited. The time is given in seconds.

In this experiment the corneal-reflex was abolished, although the central nervous system, as well as the end organs in the cornea and the conjunctiva, had remained intact. It was by the condition of the eyelid alone, which was inhibited in its freedom of movement, that the reflex was rendered impossible.

If this experiment is repeated with intervals of not more than a few minutes, or if stimulation of the nerve is continued too long, symptoms of fatigue may be observed. In the latter case, especially, the lifting of the upper eyelid diminishes gradually, and after an excitation period of about two minutes, the opening between the eyelids has regained its normal size. Under these conditions the

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reflex returns after having been absent in the beginning. This experiment proves again that only the mechanical condition of the eyelid prevented the reflex in this case. The same result is obtained when stimulation is repeated, each excitation lasting from 10-15 secs.

The moment when these symptoms of fatigue present themselves is not constant in different animals. In Fig. 2 a slight corneal-reflex, observed during the time of sympathetic excitation, is reproduced. It was obtained in an experiment where previously it had been lacking.

When excitation of the nerve is continued still longer, fatigue becomes complete and the increase of the opening between the eyelids, still visible in Fig. 2, vanishes.

In some cats the reflex cannot be abolished completely in this way: closure, if complete before, becomes incomplete, or if closure was previously incomplete,

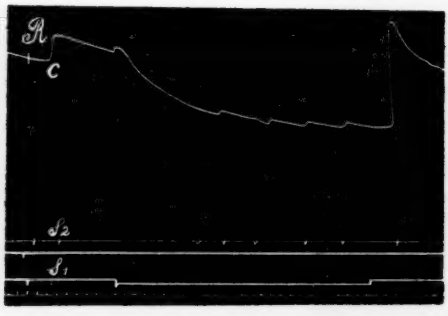

FIG. 2—Eyelid-reflex after the cervical sympathetic nerve has repeatedly been excited. S_1 = signal for excitation of the nerve; S_2 = signal for mechanical excitation of the cornea; R = movement of the upper eyelid. Time in secs. The upper eyelid is raised during excitation of the sympathetic nerve; during this time the reflex is very feeble. A normal reflex *c* precedes.

a slight movement of the upper eyelid, sometimes scarcely perceptible, can still be recorded.

In some experiments the reflex was influenced in another way: the movement of the eyelid took place much quicker than before. Whereas in the cat this movement takes about three seconds in the normal condition, this time could be reduced to one second during stimulation of the sympathetic nerve. This shortening is produced for the greater part by the quickening of the descending limb of the curve, *i.e.*, by the eyelid regaining its original position quicker. Evidently this effect must be attributed to the increased activity of smooth muscle-fibres of the upper eyelid, the fibres of Muller's muscle. It was observed repeatedly in experiments in which the eyelid-reflex had formerly been abolished completely or partially. It is clear that, in consequence of the increased opening of the eyelids during sympathetic stimulation, the summit, recorded by the closing eyelid, will be higher under these conditions than it was normally. An example is given in Fig. 3.

From these experiments it must be concluded that by the excitation of the cervical sympathetic nerve the eyelid-reflex is either abolished completely or partially, or altered. It never remained unchanged.

There are only a few critical experiments recorded in the literature dealing with the influence exerted by excitation of the cervical sympathetic on the eyelid-reflex. Kok and Harreveld (1934) investigated it in the cat. They did not succeed in abolishing the reflex in this animal by exciting the cervical sympathetic. On these grounds they denied the possibility of the eyelid-reflex being impeded in this manner. They found no distinct influence on the reflex. The cause of their negative results is difficult to understand ; it is conspicuous, however, that, in the curve they published the primary effect of sympathetic stimulation : the fall of the curve, as the expression of the upwards movement of the upper eyelid, is also lacking.

The susceptibility of the corneal-reflex to an increased activity of the sympathetic fibres of the eye is shown in yet another way.

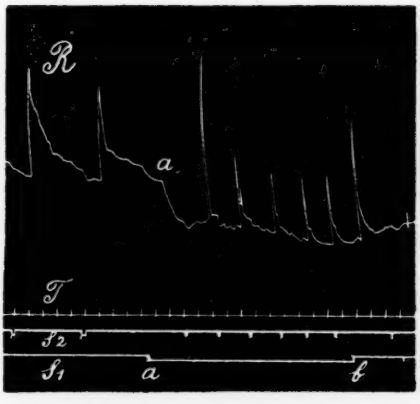

FIG. 3.—Alteration of the eyelid-reflex by stimulating the cervical sympathetic nerve. S_1 = signal for excitation of the nerve ; S_2 = signal for excitation of the cornea by a stream of air blown against it ; T = time in secs. ; R = movement of the upper eyelid. The eyelid-opening is increased by the excitation of the sympathetic nerve. Normal corneal-reflexes precede.

(1) In most cats a consensual eyelid-movement is observed after stimulation of the cornea or the conjunctiva of the other eye. In this, in contrast to man, the animal movement is not so intensive as homolaterally, but it is perceptible. By excitation of the cervical sympathetic nerve this consensual movement is abolished in animals in which it had been established before. The other eye, with its normal sympathetic innervation, showed the reflex in the normal way, of course.

The question might be put, whether it is not possible to prevent the spontaneous closure of the eyelids, also a reflex movement, by excitation of the sympathetic fibres. The spontaneous eyelid-movement cannot be used for this purpose, however, since it is too irregular as regards its frequency. The time between two movements in the cat under normal condition was found to vary between 20 seconds and 2½ minutes ; in some cases times of even 10 minutes could be observed.

In some experiments the consensual eyelid-movement was not abolished, but

the reflex brought about in the controlateral normal eye was accompanied by a small downward movement of the eyelid, which did not regain its original position afterwards. So it seemed that the contracted smooth muscle-fibres of the eyelid were stretched a little by the consensual contraction of the m. orbicularis. It is more probable, however, that the smooth muscle of Muller was inhibited reciprocally as often as its antagonist, the m. orbicularis oculi, was excited to contract.

The same reaction could sometimes be observed homolaterally during excitation of the cervical sympathetic nerve, after it had repeatedly been tried to evoke the corneal-reflex.

(2) If the animal gets excited, symptoms of excitation of the sympathetic nervous system are observed : the pupils are dilated, the opening of the eyelids is increased, the tail is gradually brought upwards vertically, etc. The completeness of the symptoms is determined by the degree of excitation of the animal. In our animals it usually did not go so far as to cause erection of the hairs. Nevertheless, in some animals the corneal-reflex was greatly decreased under these conditions, and in some experiments it was scarcely to be ascertained.

(3) When one of the cervical sympathetic nerves is cut, and before the signs of sympathectomy appear, symptoms of excitation may sometimes be observed in the eye for some minutes after the operation. In this period of sympathetic excitation the corneal-reflex can be wholly abolished. In one experiment this was the case during 10 minutes after the neurectomy. After this time the reflex began to return feebly, and after 28 minutes it had not yet reached its original height, in spite of the fact that during this whole period the behaviour of the animal agreed with that of a normal animal in all other regards.

(II) Direct Stimulation of the Eyelid Muscles.

In a second series of experiments the influence exerted on the eyelid-reflex by direct excitation of the eyelid-muscles was examined. For these experiments two needle-electrodes were used, one of which was placed in the upper, the other in the lower, eyelid after a small incision had been made in the skin.

The needles were connected with the secondary circuit of an induction coil, the primary coil being fed by an alternating current of 22 volts and 50 cycles, or by a constant current of 10 volts, interrupted rhythmically about 40 times per second. By placing a milliampère-meter in the secondary circuit, the strength of the current which passed the needles was controlled continually.

The effect of the stimulus on the eyelid-muscles, m. orbicularis palpebrarum, m. levator palpebræ superioris, m. corrugator and the m. Mülleri, is determined by the strength of the stimulus and the placing of the electrodes. If these are placed haphazardly the eyelids will be closed spasmodically, as soon as the stimulus is given, with the result that it is impossible to examine the corneal-reflex. In most cases the electrodes can, however, be placed in such a way that 8-10 secs. after stimulation had begun the spasm of the eyelid decreases and an opening of some few millimetres is left free between the eyelids, through which

the cornea is accessible. This position will be maintained as long as stimulation is continued. At the same time the membrana nictitans, by which the eye is covered during the first seconds, is retracted after 8-10 secs.

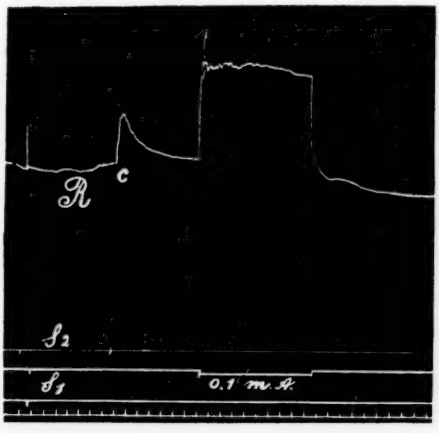

FIG. 4.—The eyelids are closed by direct electrical stimulation of the eyelid muscles. S_1 = signal for stimulation; S_2 = signal for mechanical stimulation of the cornea; R = movement of the upper eyelid; *c* = corneal-reflex. The time in secs.

In Fig. 4 a record is given of the movements of upper eyelid during its spasmodic contraction. The eyelids are closed abruptly at the onset of stimulation, and at the beginning the lever swings upwards over the plateau. This plateau exhibits small, sharp summits, especially in its first part, in consequence of

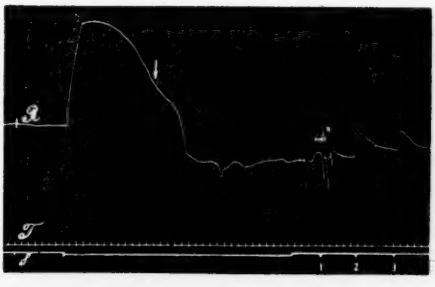

FIG. 5.—The eyelids are closed by direct electrical stimulation of the eyelid-muscles. The closure diminished gradually. S = signal for electric excitation, and at the same time signal for mechanical stimulation of the cornea after the current was opened. The three mechanical stimuli during the last 20 secs. of electrical excitation are not signalled by S; R = movement of the upper eyelid. Time in secs.

the spasm of the eyelid. This spasm causes the eyelids to close more intensively than closure occurs during the normal complete corneal-reflex (c), which precedes.

The next figure (Fig. 5) shows that the spasm of the eyelid soon decreases if stimulation is continued for a longer period. Here a current of 0.4 m.amp. was supplied during a half minute. After five seconds the spasm begins to diminish, and after 10 seconds the cornea is again visible. This point is marked by an arrow. It is not possible to produce a corneal-reflex during this period; it could

not be evoked either by touching the cornea or the conjunctiva; eight seconds after excitation was discontinued the reflex could again be elicited.

The stimulation of the cornea, given four seconds after the circuit was opened (1), does not evoke an eyelid-movement, but it is answered by licking movements of the tongue (L), which the animal flaps out of its mouth.

It is interesting that the opening between the eyelids, at first closed, may be opened during stimulation to even more than its normal width, as is shown in Fig. 5. This effect agrees with the observation made in animals submitted to the electric current (a description of which was given in an earlier paper), in so far that in this case also the sympathetic effects gradually predominated over the parasympathetics, although the latter were strongest at first.

The result is not always as has here been described. In some animals the reflex persisted feebly during excitation, in others it was elicitable again immediately after excitation. Sometimes the reflex remained absent during a longer period.

In the other eye the reflex remained unaltered.

If currents of less than 1 m.amp. are used, it is not always possible, however, to place the electrodes in such a way that an opening is left free between the eyelids during excitation. As it was intended not to use stronger currents, which do not give this trouble, the spasms of the eyelids had to be prevented in another way, viz., by combining direct excitation with stimulation of the cervical sympathetic. The results will be described under III.

It was proved in different ways that the results given here were really evoked by excitation of the end organ of the reflex—the eyelid-muscles—only, whilst the central parts remained unattacked.

(*a*) As has already been stated, the reflex of the other eye remained unaltered, even when a current was given ten times as strong as the current used in the experiments.

(*b*) If the electrode of the under eyelid was removed to a point on the middle line of the forehead at a distance of about 3 cm. from the other electrode which was left in its place, the corneal-reflex remained positive whilst the same current was used. The eyelids were closed again, but less vigorously.

Nor was it possible to abolish the corneal-reflex by placing the electrodes on the skull between the ears.

The possibility that the reflex could have been abolished by pain, which would have its origin in the electrical excitation of the skin or subcutaneous tissues, was disproved by the negative result, observed after excitation of any other part of the body.

(*c*) The arterial blood-pressure was recorded during excitation. The currents used in the experiments were so weak that not a trace of action on the vasomotor centre of the medulla could be detected, although that centre was found to be very sensitive to the stimulus; the strength generally used was less than a half of the minimal stimulus for this centre.

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(*d*) In one experiment the consensual eyelid-movement at the other side could still be observed, while the homolateral reflex was abolished by the direct excitation of the eyelid-muscles. Here the electric current employed was more than ten times as strong as commonly used. This fact proves irrefutably that the efferent reflex-path, as well as the centres themselves, had retained their ability to conduct the excitatory process. The contralateral efferent reflex-path was proved to be also free. So it is only by seizing upon the effector, the eyelid-muscles, that the homolateral eyelid-reflex was rendered impossible ; the eyelid had lost its freedom to react to the stimulus which it received in the normal way from the efferent reflex-path.

Analogous experiments have been performed in six cows. By direct excitation of the eyelid-muscles by currents of 0·6-2·8 m.amp. the eyelid-reflex could be completely inhibited, whilst the contralateral reflex remained unchanged. The excitation was continued for 10-20 secs. In these animals it was found that by the decrease of the eyelid-spasm the lids were opened in another way than was the case in the cat. Whereas in the cat the eyelids formed a cleft-shaped opening, increasing slowly in width over its entire length, the upper eyelid of the cow was raised only in its central parts, the ends remaining completely closed. The eyelids were not opened sooner than $\frac{1}{4}$-$\frac{1}{2}$ minute after the beginning of excitation.

The controls mentioned under under (*a*), (*b*) and (*c*) were also used here. The consensual reflex is very inconstant in the cow.

During the experiments the animals were either lying down or else on their feet. In the latter it was easy to state that the movements remained restricted to the eyelids and that respiration proceeded quietly.

In some experiments, when the cornea of the cow was touched, it was followed by a movement of the eyeball and of the nictitating membrane, whilst not a trace of eyelid-movement was observed. This fact also demonstrates the local action of the excitation, by which the eyelids and not other parts had obviously been immobilised.

(III) Combination of Excitation of the Sympathetic Nerve with Direct Excitation of the Eyelid Muscles.

When direct excitation of the eyelids is applied, together with excitation of the cervical sympathetic nerve of the same side, the eyelids are totally or incompletely closed. If closure is complete this only holds for the first seconds of stimulation, for after 4-8 secs. the bulb becomes visible, whatever strength of current may have been chosen for direct excitation. Consequently very weak currents could be used here (0·1-0·5 m.amp.) with the advantage which was discussed under II.

As a rule currents of 0·2 m.amp. were used for direct excitation. The effect on the eyelid-reflex varied again in various animals. It was mostly impossible to evoke it during excitation. Sometimes it remained absent during some seconds after excitation was arrested ; the longest period found was eight seconds.

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In other cases the reflex was only decreased during excitation. It never remained unaltered.

In Fig. 6 an example is given in which the reflex is positive again, some few seconds after stimulation was arrested.

If we now try to answer the question whether or not one may be assured that the effector, the eyelids, are free to react when the eyelid-reflex is used, in order to test the condition of the central nervous system in animals submitted to the electric current in order to stun them, there can be no doubt regarding the answer. The experiments described give the answer in the negative. They prove that this freedom of the eyelids is impeded by direct excitation, by excitation of the cervical sympathetic nerve, and by the combination of the two. The freedom to move can be abolished completely.

The excitation, as it was applied in these experiments, is also found in animals submitted to the current for the purpose of stunning them, and even in a degree

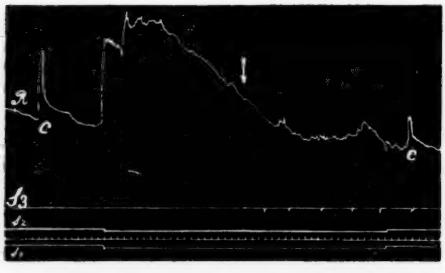

FIG. 6.—Direct excitation of the eyelid-muscles and excitation of the cervical sympathetic nerve. S_1 = signal for sympathetic excitation; S_2 = signal for direct excitation of the eyelid; S_3 = signal for mechanical excitation of the cornea; R = movement of the upper eyelid. Time in secs. The arrow indicates the moment that the bulbus becomes visible. Eyelid-closure decreases during excitation; the reflex is abolished during this time. An eyelid-reflex precedes and follows (*c*).

many times stronger than in these experiments. The consequences are clear. Little ground remains for any conclusion other than this: that the current used in order to stun the animals highly impedes the availability of the eyelids, and therefore removes the reliability of the eyelid-reflex as an index of the condition of the central nervous system. This applies to the time during which the current passes the skull as well as thereafter.

It must be pointed out that it is not only by counteracting the closure of the eyelids by the contraction of the opening-muscles that the reflex is hindered. This contraction is not even the most important one. All eyelid-muscles, the closing-muscles included, are brought into a condition of spasm, by which it is impossible for them to react anew to a second stimulus, which they receive from the cornea and the conjunctiva *via* the reflex-path. As was shown, the effects do not vanish as soon as excitation is stopped.

Consequently the value of the eyelid-reflex is of far less importance in judging the state of the central nervous system in animals subjected to the electric current than in the animal under chemical narcosis. In the former case the reflex is

even unreliable, and consequently useless for the purpose. Only its presence is of value. A conclusion concerning the condition of the central nervous system, when the reflex is lacking, cannot be arrived at.

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LOSSES DURING A FLOOD IN A VICTORIAN DISTRICT OF AUSTRALIA.

By H. B. RUDDOCK, M.B., B.S., B.V.Sc.
Melbourne, Australia.

I WAS engaged testing cattle with tuberculin near Koo Wee Rup, a small township 35 miles from Melbourne. This district has particularly rich soil, most of it being reclaimed swamp, very flat country, and several large drains or canals. It is situated at the foot of a mountain range, the water from which is usually carried directly by the canals through the swamp area to the sea.

The farming carried out here is mostly potato-growing, dairying, and a small amount of sheep and cropping.

An exceptionally heavy and sudden fall of rain took place: as much as over eight inches fell on the ranges in 24 hours—a total of about 11 inches in three days. This water collected and came rapidly down from the hills, but on reaching swamp country the rate of flow decreased, the water soon banked up and flooded the surrounding area.

This took place very rapidly. In the evening things were apparently normal; by the following morning three feet of water was lying on the ground at the farm where I was working. Fortunately, we were on slightly higher ground than our less fortunate neighbours. Even so we had to throw "sleepers"—large pieces of wood 6 ft. by 6 ins. by 4 ins.—into the pigstye to save the pigs from drowning.

At the farm 400 yards from us the water came into the house and the people had to stand on chairs or tables. The cows had to be milked, but since, even on the highest places, their udders were well under water, the milk had of necessity to be lost as it was milked under and into the water.

Some farms had oaten or meadow hay crops either just cut or ready to cut. Those that were not cut were completely ruined with water and silt; those already cut went gaily floating away gradually to the sea. Isolation was complete; the roads were completely under water, the railway line washed away, the telephone out of order, no mail, daily paper, grocer, or butcher. The only means of getting about was by horseback, and we could only make contact with

our immediate neighbours. Everything was a sea of water as far as one could see, with only buildings, trees or huddled groups of cattle in sight. Bad as it appeared to us, we were in the higher parts of the flooded area, and though it did not appear so at the time, were faring comparatively well.

As the days passed rumours began to filter through about how the others had suffered, but it was not for five days that we were able to go along roads for any distance and see for ourselves just how things were.

While confined on the farm I put in my time doing ordinary farm work, milking, feeding cows, calves, separating, etc., though under unusual conditions. As soon as I was able I drove seven miles, through water varying in depth from 2½ ft. to 6 ins., to the township.

Here I took several photographs, and, as can be seen by them, the main street was still under water—in fact, a boat was in use. Carcases of animals, mainly sheep and cattle, were present in large numbers, left just as the flood had left them—drowned, washed on to trees, against bushes or fences. Some indication of the height of the flood may be gathered, as the body of a cow was left on the fence after the water subsided.

There were many tales as to the severity and suddenness of the flood—that at one time in the town the water was rising at a foot a minute ; of the hospital patients who had to be removed through the roof of the hospital ; of cattle drowned in the milking bails because there was no time to let them go ; of one man who lost 200 cows and all his possessions ; and many others.

As I was leaving for headquarters—Melbourne—when the roads were again passable, there was a large lorry drawn by two horses moving slowly down the main street. Three men were gathering dead sheep from the roadside, piling them on the wagon to be taken to the sea. People were re-entering their homes —washing, cleaning and hanging things out to dry—to settle down again and take up their duties where the flood had interrupted them.

Clinical Articles

Cerebral Tumour in a Trotter.

By H. B. RUDDOCK, M.B., B.S., B.V.Sc.
Melbourne, Australia.

THE patient was a nine-year-old gelding. He was first seen during an attack of acute mania. He was confined in a small stable and was endeavouring to climb up the wall.

Previous History.—The trainer had noticed a slight awkwardness of gait, a tendency to bear to the left when trotting, and difficulty in guiding him to the right.

Prognosis.—The possibility of recovery from this attack was mentioned; the probability of another developing at, and the danger associated with, attempting to train this gelding was pointed out. Immediate destruction was advised.

The animal was allowed to recover, but on the development of a similar attack three weeks after the initial one, the animal was destroyed. Examination of the brain showed a cholesteatoma, almost as large as a hen's egg, protruding into and filling the right lateral ventricle.

Intestinal Stenosis in a Bull.

By H. B. RUDDOCK, M.B., B.S., B.V.Sc.
Melbourne, Australia.

A STUD red poll bull, aged 7-8 years, developed diarrhœa; at first this was intermittent, later more frequent, finally continuous.

The appetite, from normal, became capricious, and in the later stages the animal was kept alive only by hand-feeding with milk, eggs and gruel from a bottle. Wasting, initially, had taken place slowly, but had become marked; it was associated with extreme weakness, rendering the animal physically unable, though still willing, to attempt service. The condition was noticed some 6 to 9 months before advice was sought.

Rectal examination revealed a marked funnel-shaped stenosis of the intestine through which even one finger could not be passed. The stenosis was due to a tumour about two feet from the anal orifice in the bowel wall completely surrounding the lumen.

Post-mortem.—Revealed a lipomatous tumour completely involving the bowel wall for three feet. Several small, similar tumours were present in other parts of the intestine, one at the pylorus. Some mesenteric glands were involved.

Abscess in Thorax and in Abdominal Cavity.

By Principal J. J. O'CONNOR, M.R.C.V.S.
The Veterinary College of Ireland.

Subject.—Aged thoroughbred mare.

History.—Was bought at the December Newmarket Sales and was then in very good condition. She was by Gainsborough, and it was the intention of the owner to try her at the stud.

On February 29th she was brought to the College for treatment. Four weeks prior to this the mare seemed abnormal, though not definitely ill, and the owner thought that the affection would pass off. As she did not improve he called in his veterinary surgeon, who noticed a small swelling on the right chest wall a little above the level of, and about nine inches behind, the point of the elbow. It assumed the appearance of an abscess and was opened, when fully three gallons

of stinking pus escaped. As the surface swelling was not extensive it was concluded that the pus must have come from the chest cavity, yet the symptoms did not then indicate lung trouble as the respirations were not hurried and the temperature never exceeded 101°F.; it was usually 99° in the morning and 101° in the evening. She fed indifferently, taking a little hay and mash. Milk was given to her through a drenching bit.

Symptoms.—Her condition was approaching emaciation. The anus was sunken. The pulse was 50 and weak. The conjunctiva was injected, but not deeply, and was not "dirty." The coat was not staring. The respirations were quiet. The mare was dull and indifferent to her surroundings, although at home she neighed when she saw other horses. On rectal examination the right kidney could be distinctly felt and pressure thereon was resented. After three days in hospital the mare got worse, the respirations increased to 36 per minute. She resented pressure on the chest wall on both sides. Percussion revealed dullness in the lower part of the chest cavity on the right side. On auscultation no sounds could be heard in the lower part of the chest wall on either side, but there was distinct blowing in the upper part. Occasionally a very offensive smell was emitted with the expired air, like that from a gangrenous lung. The orifice of the opened abscess was still discharging a small amount of pus, and a probe inserted into it could only be passed for about three inches in an oblique direction.

Diagnosis.—Probably an abscess in the right lung with adhesion of the lung to the chest wall, and also an abscess in the region of the right kidney. It was surprising that the pulse and respirations were not more frequent and that the conjunctiva was not more injected.

Prognosis.—The owner was told that nothing could be done for the mare and that she would soon die, but he did not seem satisfied and took the mare home, where she died soon after arrival.

Post-mortem.—The post-mortem examination was made by another veterinary surgeon, who reported that an abscess was found in the mediastinum communicating with a collection of purulent fluid in the right pleural sac, where the lung was adherent to the chest wall, and that there was also an abscess in front of the right kidney. No further details of the post-mortem were received.

Chronic Tuberculous Abscess in Mare's Shoulder.

By Principal J. J. O'CONNOR, M.R.C.V.S.

The Veterinary College of Ireland.

Subject.—A very good chestnut draught mare, 17 years old, in excellent condition, which had given several years of good service to her owners.

History.—A chronic abscess had formed at the point of the near shoulder which was opened by a veterinary surgeon, but refused to heal, a sinus persisting.

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Cholesteatoma in brain of nine-year-old trotter.

(*Article by* H. B. Ruddock, M.B., B.S., B.V.Sc., *page* 138)

Lipomatosis of large intestine of red poll bull.

(*Article by* H. B. Ruddock, M.B., B.S., B.V.Sc., *page* 130)

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Symptoms.—A tumour, almost the size of two fists with a discharging orifice in its centre, was observed at the place mentioned.

Treatment.—On October 5th the mare was cast and anæsthetised and the tumour was dissected out.

On opening the tumour afterwards, its centre was found to be a cavity containing thick pus. Prof. Kearney subsequently made a section from the tumour, and found in the section an organism which he recognised as the tubercle bacilli. The wound healed perfectly, but on December 15th the mare became affected with marked œdema of the breast and fore-limbs. The temperature now varied up to 104° and she fed indifferently. The symptoms were those of chronic pleurisy. The mare was then tested for tuberculosis with the following result. Temperature at injection, 101° ; temperature five hours later, 105° ; temperature 12 twelve hours later, 106°. She was then destroyed.

Post-mortem examination revealed tuberculous lesions in (1) the prescapular lymphatic glands, which were calcareous ; (2) the lungs, here and there ; (3) the tracheal lymphatic glands, which were very enlarged and calcareous ; (4) the hepatic lymphatic glands ; (5) the mesenteric lymphatic glands, with the presence of calcareous matter ; (6) the lumbar lymphatic glands. The liver was not affected. Pleurisy was present and the chest was full of fluid.

An interesting feature is that the mare was in perfect condition and had no history of illness until she developed pleurisy subsequent to the removal of the tumour.

Purulent Fistula in a Cow's Udder.

By Principal J. J. O'CONNOR, M.R.C.V.S.

The Veterinary College of Ireland.

Subject.—Shorthorn dairy cow.

History.—There was no definite history of the case.

Symptoms.—A granulating tumour-like mass of tissue about the size of a child's head protruding from one quarter of the udder. The cow was in normal health. The condition had resisted local treatment and was sent in for operation.

Diagnosis.—The condition was diagnosed as a tumour with a suppurating centre, but on examination afterwards it was concluded that the condition was a chronic abscess with a thick fibrous wall which had failed to heal for want of proper drainage from its cavity.

Treatment.—It was decided to amputate the two quarters of the affected side of the gland, but when the beast was cast and anæsthetised and the lesion thoroughly examined and seen to be well circumscribed, it was resolved to dissect out the fibrous enlargement instead of amputating the quarters. Eudrenine was injected locally and excision of the lesion was carried out. During the operation

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several vessels bled profusely and they were secured by ligation. The operation was performed on June 2nd. An antiseptic dressing, covered by gauze and cotton-wool, was applied and kept in position by a suspensory bandage. The amount of tissue removed weighed 3lb. The cow seemed to go on all right until June 5th, when she went off her feed, and her temperature was 106° and the pulse more frequent than normal. She was given laxative and febrifuge medicine. On June 8th the temperature was 106° and the pulse 108. She ate some grass and took a little gruel and was given half a gallon of milk per tube. On June 10th the temperature was 106° and pulse 108 and she ate three bundles of grass in the morning and more in the afternoon and looked brighter. It was believed that a change for the better had occurred.

The operation wound was now covered with a layer of black necrosed tissue which was coming away in bits at its periphery, exposing pink granulation tissue. The gland in the vicinity was hard and swollen and there was an offensive smell from the lesion ; clotted discharge could be drawn through the teat of the affected quarter.

On June 11th the pulse was 90 and the temperature 105°. The weather became extremely sultry. The apparent improvement shown on the 10th inst. was not sustained, and the cow died from toxæmia due to gangrene resulting from infection of the operation wound in the udder.

The local daily treatment comprised (*a*) irrigation at different times with hydrogen peroxide, 1 : 4 ; chinosol solution 1 : 1000 (boiled water) ; biniodide of mercury, 1 : 1000 ; eusol ; tincture of iodine ; (*b*) dusting with iodoform and boric powder, 1 : 10. No attempt was made to excise the dead tissue. The cow was given milk and eggs daily, through the stomach tube, passed through the nose when she refused to feed. The result of the operation illustrates the folly of making a large gaping wound in the mammary gland during lactation.

It is impossible to protect it from infection. On examining the lesion after its removal, it was found to be a smooth abscess cavity with thick walls and a mass of granulation tissue concealing its orifice.

If this had been recognised in time and a free exit for drainage made, followed by the injection of an irritant antiseptic, cicatrisation might have ensued without any complication ; or, alternatively, if amputation of the two quarters had been performed there would have been a better chance of recovery.

Eversion of the Uterus in the Cow.

By RICHARD HUDSON, F.R.C.V.S.
Retford.

I suppose every country practitioner has wondered why such cases usually occur at night. Or am I particularly unfortunate in having most of my cases " after hours " ?—for, looking back over a number of years, I can remember only one or two in the daytime.

The subject was a heavy Lincoln Red Shorthorn cow at the fourth calving. The cause of the mishap was probably the severe slope of the stall, for one was about one foot higher in front than behind. This, and the weight of a full rumen, had no doubt assisted in forcing out the uterus during straining to expel the placenta. The time was midnight; the assistance the farmer and two young boys. The light was a smoky lantern and a candle fixed on the wall. The byre was beyond description. The patient was the last of the row and the drainage fell to her. It was obstructed by her hind quarters, the prolapsed uterus and a mass of fæces.

The farmer, catching my expression, remarked, "I expect it's a killing job." She was worth about £26, and there would have been about £3 for him, and could we get her dressed at that hour of the night? There were chances of death before it could be done. So, we had to set about replacing it.

As she had to be raised clear of the filth, pulleys were necessary, and while they were being fixed I got ready what I required. Two bucketfuls of water with 1 ounce of carbolic acid in each, towels, soap, pint bottleful of castor oil, half pound of lard, a big needle and twine, a short strong rope and chloroform muzzle.

When the pulleys were about fixed the muzzle was placed in position, with two ounces of chloroform on muslin and the end tied up (my muzzle is a large box pattern and the mouth goes in).

The hind legs were tied together above the hocks, and she was raised until the womb was clear of the ground. Her tail was tied forward out of the way. Excreta in the channel was cleared away and bedding put down. The womb and placenta and the region of the vulva were quickly washed, the placenta was carefully detached and the womb again washed with the hands only. A thin towel was tied loosely round the end of the womb, and the womb held up by an assistant.

My hands and arms were well oiled, as was also the womb, plenty of oil being worked into and about the vaginal entrance. The mass was gently massaged for a few minutes—working towards the vagina to soften and reduce it—and then replacement began.

Working at the vulva with plenty of lubricant poured on, and the straining efforts being absent owing to the anæsthetic, replacement was easy and without injury—except for the sloughing off of two or three cotyledons.

The lard was now inserted and the remains of the castor oil, and with my hand inserted as far as I could reach, the womb was moved about to straighten out the ends of the cornua.

As I was not sure that I had been successful on this point, having raised the floor with bedding, I removed the muzzle and lowered the hind quarters, the vagina being closed with sutures.

Tape is recommended, but binder twine does as well if it is clean and thin. Suturing is rarely necessary. Three sutures were inserted, each of double twine.

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One section of each suture was tied across as in a wound suture; the other sections were tied to each other along the sides of the vulva. It is a good suture, closing and preventing vertical stretching.

The patient was now propped up on her chest, for she was becoming conscious, and by the time I was washed and dressed she was wanting to get up.

As I like to have them up as soon as possible, she was encouraged to rise, for it helps the womb to assume its natural position.

Before leaving, she was rugged down, given 12 oz. mag. sulph., the bedding being well arranged, and a light diet advised.

Visiting the next day, I found her looking rather sick but showing no bad symptoms. The sutures were removed. On the day following she was cudding and on her feed, so she was turned into a yard for exercise.

The womb needed no after-treatment, or rather, it did not get any, and within a fortnight she was in the market and made £24.

Remarks.

Chloroform and Spinal Anæsthesia.—Chloroform is safe. It has never let me down in these cases. The effect is rapid, duration sufficiently long for the case, and recovery is rapid. The sooner they are up the better.

With regard to other anæsthetics and hypnotics, the same remarks apply.

Slinging.—It is not always necessary to sling up the hind quarters if the cow is lying on level ground or can be pulled on to it.

I have often chloroformed them standing and let them down by its influence, keeping them tied up, of course, and bedding the stall a yard deep halfway up the stall.

Castor Oil.—Castor oil I find the best lubricant; oil and lard in abundance help in reducing unreachable inversions and prevent serious sepsis and straining of the womb.

I used to wash out after a few days, but I have given it up for the reason that fluids are retained, and often the walls of the uterus are very thin and easily penetrated during manipulation. I once had such an accident with a soft rubber tube, which would not have penetrated tissue paper.

Suturing of the Vulva.—It is rarely necessary, but it does no harm, and risks should not be taken. If the sutures are removed in 24 hours they leave little trace.

Magnesium Sulphate.—I never leave a calving or foaling case without giving mag. sulph. in the former and aloes in the latter, and the same with prolapse of the uterus. I am convinced that by doing so I have saved many a case. If they are very exhausted, strychnine, 1 grain, is beneficial, and the dose of mag. sulph. is given as soon as they can swallow with safety.

Exercise.—Exercise the next day or the day following, or turn into a yard or paddock. It assists the ejection of blood clots and discharges.

They are always septic after replacement, but it is only occasionally that it affects them seriously. If it does, iodoform 1 dr., boracic acid 2 oz., lard 6 to 8 oz.

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should be inserted, if possible. If insertion is prevented by the closure of the os, iodoform ether (1 in 8), 1 oz. in 8 oz. of oil, should be injected with a soft rubber tube and funnel.

Internally, acetanilide, 1 dr. to 2 dr. three times daily, has given the best results.

Amputation.—It is only to be adopted where laceration of the organ has taken place or where the os has closed so far that the uterus cannot be made to pass through it.

The operation is attended with great risk of death from shock, particularly with animals calved to time or near it. With premature parturitions the risk is not so great.

The Valice as an Aid to Replacement.—A contrivance has been invented by Mr. Scott, of Pontefract, which is intended to enclose the womb before replacement, and is satisfactory in that it prevents injury and facilitates introduction, but with the use of anæsthesia I have not found replacement at all difficult.

An Unusual Condition in a Guernsey Cow.

By J. WILLIS THWAITE, M.Sc., B.V.Sc., M.R.C.V.S.
Liskeard.

THE subject of this note was a Guernsey cow which had dropped her second calf, a dead one, in October, 1935. She was not bulled afterwards. She apparently milked well on her first lactation, but after the second calving she never gave more than about a quart of milk at a meal, though she ate well and seemed to do well.

I was first asked to see this cow on February 14th. Apparently the cow was quite well up to that morning, when the herdsman complained that she seemed to be restless and frequently kicked forward at her udder with her hind legs. He thought she had colic, and, as I was away at the time, he received 1 lb. of $MgSO_4$ with which to drench her. I saw the cow the following morning, when she appeared normal and was eating quite well.

On February 17th she showed a repetition of the symptoms, so was put on a course of nux. vom. and sodii bic., with linseed cake, meal, bran and hay. This treatment seemed to have a temporary beneficial effect, but later the old symptoms reappeared.

About this time the cow began to show a marked tendency to dip her back, as though stretching herself, and would remain in this position for several minutes at a time. The symptoms, taken as a whole, conveyed the impression of great uneasiness.

I saw the cow again on February 27th, and as she was no better I made a rectal examination, and found a condition present which I was unable, definitely, to diagnose. Surrounding the last portion of the bowel, as far as could be reached, were numerous hard growths, varying in size, but averaging about 3 or 4 inches in length. These were not smooth, but seemed to have an irregular outline. The rectum had lost a good deal of its elasticity and did not dilate as it usually does. I

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suspected the condition to be tuberculous, but the cow had passed the double intradermal test about twelve months previously, and she was one of a very healthy herd. The owner, however, agreed to have her retested, and she again passed the double test without any difficulty. After this we agreed to wait a little while and see what happened.

On March 9th, I was again asked to see the cow, as she had gone off her food. A rectal examination revealed the condition to be definitely worse. I had difficulty in inserting my arm into the rectum, the lumen of which had appreciably narrowed. As the cow was losing flesh the owner decided to have her killed, and as I expressed a wish to see the carcase, he kindly arranged to have her slaughtered locally.

The post-mortem revealed an interesting lipomatous condition. The internal organs were all healthy and the trouble was confined to the fatty tissue of the carcase. The fat was a very deep yellow colour and there seemed to be an abnormal quantity of it. The swellings which could be felt per rectum before death were seen to be solid accumulations of fat which lay along the course of the bowel, culminating in a huge lipoma which had surrounded a portion of the intestines and which measured 18 inches in length by 14 inches in thickness. This was quite hard and firm and when cut across showed several cut ends of loops of intestine. When the last two feet of the bowel was removed it could be held almost rigid on account of the support the tumours afforded it. Other similar tumours were found embedded in the kidney fat and along the abomasum.

I am indebted to the Institute of Animal Pathology, Cambridge, for the following note about this case.

" An examination of the specimen received on the 11th inst. revealed a diffuse, lipomatous condition. The occurrence of abnormal accumulations of fat is not uncommon in cattle and it has not been definitely determined whether, or not, they are neoplastic in character."

Multiple Stones in the Stomach of an Alsatian.

By JOHN HICKMAN, M.R.C.V.S.
Royal Veterinary College.

Subject.—Alsatian bitch, aged three years.

History.—During the last three months has persistently picked up stones, and was seen to swallow one three hours previously. The bitch had never been off colour, nor had she been known to vomit.

Examination.—Bitch in good condition, and very bright. Temp. 101.2°. Stones could be heard to rattle on percussion of the epigastrium.

Treatment was carried out by producing emesis after giving forced feeds, which consisted of boluses made up of breadcrumbs and meat, the total bulk weighing about 1 lb. Vomition was produced by giving about 2 drms. of washing soda.

1st Day.—Fifteen minutes after ingestion of forced feed, washing soda was given, which produced emesis in 1½ minutes, the whole of the feed being returned with no stones. In one minute she again vomited, producing three stones—the total weight of these being 3¾ oz. Ten minutes later she was given a second piece of soda. This produced emesis in three minutes, which resulted in the recovery of two more stones—their weight being 2½ oz.

2nd Day.—Stones could still be heard on percussion. After forced feeding, soda was again given, and the bitch vomited twice with no success. An X-Ray picture was taken which showed at least two stones in the stomach, with the intestines clear.

3rd Day.—1/25th gr. apomorphine hydrochlor. given five minutes after food, emesis being produced 20 minutes later, resulting in the recovery of a large stone, weighing 4¾ oz.

4th Day.—X-Ray examination revealed two smaller stones in the colon, which were removed by enemata.

During the period of treatment the bitch remained bright and never vomited other than when induced. She was kept on a fluid diet consisting of milk and meat extracts.

Remarks.—Interest of this case lies in the fact that foreign bodies which are smooth and large may remain in the stomach over a considerable period without causing any untoward discomfort or symptoms, and when several are present they may be recovered by vomition.

I am indebted to Mr. J. B. Orr, of the Royal Veterinary College, for the excellent photograph.

Symptoms of Ruptured Diaphragm Delayed Sixteen Days Following an Injury in the Dog.

By HENRY GRAY, M.R.C.V.S.

Kensington, W.8.

TOWARDS the evening of December 29th, 1935, a male Scottish terrier that had been run over by the driver of the motor car was brought to me. It did not belong to the driver but to a client of mine who was away from home. All I observed was that the animal was quiet and dull and had a broken claw, which was bleeding.

The day following the owner turned up, and as the dog did not seem to be suffering she took it away.

About 2 p.m. on January 14th, 1936, she brought it round to me, as half an hour before, immediately after it had had its dinner, it was seized with attempts to vomit, and appeared to be choking from some obstruction in the œsophagus.

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When I opened its mouth I found that the tongue and other parts of the mouth were pallid and covered with a spumous mucous froth and the veins were purple and showed up well against the pallid mucous membrane. To make sure there was no œsophageal obstruction I passed the probang, and in doing so the animal appeared to be in great distress, and made many attempts to vomit. The probang was passed without any obstruction being discovered. When the animal was placed on the ground he gently assumed the recumbent position and did not manifest any further distress. The conjunctival mucous membrane was pallid and the pulse at the femoral artery was infrequent and gave a running down or back-telling sensation to the touch. A few minutes later death supervened. I suspected a breaking down of an old hæmorrhage as the result of the accident.

A few hours later I made a *post-mortem* examination, when I found the liver in close contact with the posterior surface of the diaphragm. On opening the thoracic cavity the distended stomach was pressing close to the sternum, and filled the cavity more to the left side. Before I could push it back through the opening in the diaphragm I had to puncture the stomach to let out the superabundant gas, and then I could easily withdraw it into the abdominal cavity. The rent or perforation was near the upper part of the diaphragm close to its attachment under the dorsal vertebræ but nearer the left of it. I could pass three of my fingers through the rent. There was no hæmorrhage or exudate either in the pleural or abdominal cavities. The stomach was half-full of pultaceous ingesta which contained a few lumps of meat.

There is no doubt that pressure of the distended stomach on the lungs, heart and large blood vessels gave rise to the suffocating, choking and vomiting symptoms. The bending of the œsophagus prevented the stomach emptying itself and the distension of the stomach on its pyloric extremity in the vicinity of the perforation brought about strangulation by the diaphragmatic ring griping the pylorus and preventing the ingesta passing into the duodenum.

Since the dog left me on December 30th he had taken his food as usual and was as lively as ever, much more so on January 14th, as he never played and barked so much in a good-tempered or playful manner as on the morning of that date just before he had his dinner and ate it with avidity, when soon after he attempted to vomit, appeared choking and was in great distress for half-an-hour before he was brought to me.

The symptoms manifested were similar to those I have on several occasions witnessed in cats choked with large cylinders of fur extending from the cardiac end to the pharyngeal end of the œsophagus. In such cases the cylinder has had the diameter of a broom-handle to that of a medium-sized wrist.

Although I have encountered numerous cases of ruptured diaphragm with the stomach and liver in the pleural cavity in cats and dogs, a few of which have survived three or four days, I have never before come across

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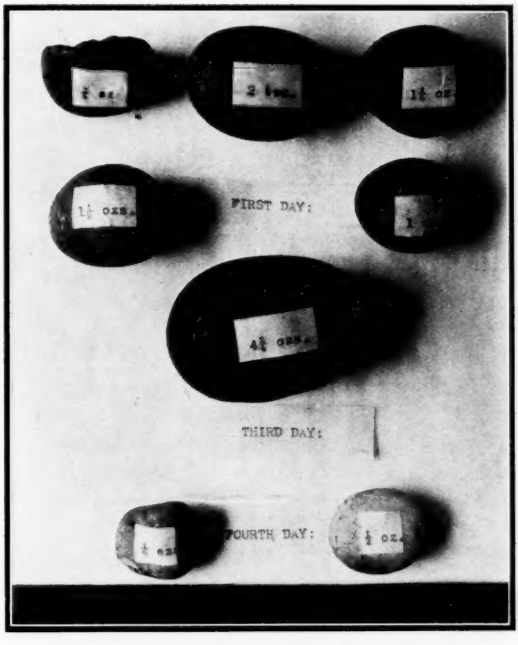

Multiple stones in the stomach of an Alsatian bitch.

(*Article by* John Hickman, M.R.C.V.S., *page* 146)

one that has lasted so long without showing any symptoms indicating its existence. We live and learn. The Father of Medicine was not wrong when he said more than 2,000 years ago that "Experience was fallacious and judgment difficult."

Parasitic Canker with Scratch Sore on Cheek in the Cat.

By HENRY GRAY, M.R.C.V.S.
Kensington, W.8.

In a paper on Veterinary Otology which appeared in *Veterinary Research*, No. 19, Vol. 9, May 11th, 1929, I mentioned :—

"The complications or effects of this parasitic malady are many :—

"1. Not infrequently there appears on the skin at the back of the root of each ear a coarse, thickened *abrasion*, from the diameter of a shilling to that of a florin or more. This is due to the constant scratching of the region by the hind claws of the cat," etc., etc.

To this I wish to add that in some cases of parasitic canker the part scratched and rendered raw is the skin covering the cheek, producing a scabby patch almost the size of the palm of one's hand. At first sight one might suspect it as ulceration set up by discharge from an antral fistula, due to perforation of the floor and suppuration of the antrum by a pyorrhæic tooth root. On second examination it is discovered that the ears are the seat of *Symbiotes auricularum*.

Instillation of a solution of creosote 2, tincture of iodine 4, and industrial spirit to make 24, into both ears, without any treatment of the sore, shows a rapid improvement when the lotion is applied again on the third day, and its almost disappearance three days later when there is a further dressing. The ears rarely require a fourth application, which goes to show that if one removes the cause the effect will cease.

Ninety-five per cent. of ear troubles and sores at the back of the ears and on the cheeks of cats are due to this parasite, which appears in most of the carnivora, that is if one looks for it. The reflex irritation may last for some time after the original cause (mites) has been removed.

MEMORANDUM ON THE MILK (SPECIAL DESIGNATIONS) ORDER (DRAFT) 1936.

The People's League of Health is indebted to the Minister of Health for the opportunity of studying the Draft, dated January 24th, 1936, of the Milk (Special Designations) Order proposed to be made by the Minister and to come into operation on the first day of April, 1936 ; and the League with great respect desires to submit the following comments :

(1) The League takes this opportunity to repeat its conviction that both laboratory and practical experience prove that the use of raw milk as food, unless

certain precautions are taken, involves the risk of tuberculosis and also of other infections. One of these precautions is that the cows yielding the milk shall have passed successfully a properly conducted tuberculin test. Another is that the milk shall have been efficiently pasteurised or subjected to some equivalent heat process. An emphasised safety is obviously secured if both of these precautions are brought into operation, and the League appreciates in principle the provision of the new Draft Order which permits such combination under the term " Certified (Pasteurised)."

(2) As it is however certain that for economic and other reasons milk from tuberculin-tested herds is not available for the main body of the people, the necessity for insisting on the protective importance of pasteurisation (or its equivalent) continues to be urgent; and the League welcomes statements to this effect as expressed by the Board of Education (Circular 1437) and by the Chief Medical Officer to the Ministry of Health in his recent Report (p. 116). It is under the influence of the conviction that " safe " Milk is an absolute essential for the protection of the community, and especially for the protection of children, that the League has considered the designations proposed in the new Draft Order.

(3) In relation to the designation " Accredited," the League desires strongly to urge that this term will carry to the public ear a guarantee that milk so labelled is of the highest standard of value, both of cleanliness and of safety. If, indeed, this guarantee existed there would manifestly be no need for any higher class of milk, and the setting up of a variety of milk to be marked " tuberculin tested " would be superfluous. Manifestly, if the conditions demanded for " tuberculin tested " are necessary to secure safety, the conditions demanded for " accredited " are insufficient for this aim. And this conclusion is emphasised by the regulations imposed on the " attested herds " organised by the Ministry of Agriculture and Fisheries, one of these being that milk supplied as food to such herds shall be obtained from tuberculin-tested cows, or, failing this, shall be " pasteurised or sterilised by heat." If these conditions are necessary to protect cows from tuberculosis, a lower standard of protection cannot justifiably be offered to men and women and children. Yet, admittedly, " accredited " milk in the new Draft Order is of a lower standard of safety, though the term itself implies that in relation to all its qualities—purity, cleanliness and safety—it is worthy of confident acceptance and credit.

(4) Again, if " Tuberculin Tested " is the appropriate name for milk obtained from tuberculin-tested herds, the League submits that when such milk has been pasteurised the correct term is " Tuberculin Tested (Pasteurised)," just as if " Certified T.T." had been selected the corresponding term would, as an accurate description of the facts, be " Certified T.T. (Pasteurised)." The names " Tuberculin Tested " and " Certified (Pasteurised) " suggest, when read together, some difference other than that indicated by pasteurisation, whereas as a fact there is no such difference. The League has long been satisfied that

permission to pasteurise milk obtained from tuberculin-tested herds meets a reasonable demand.

(5) In previous communications (August, 1934, July, 1935) the League has expressed its general agreement with the special designations advised by the Cattle Diseases Committee, subject to two modifications, namely, that the first variety " Certified " should be named " Certified T.T.," and that to the fourth variety, that is " milk (uncertified)," should be added the phrase " should be boiled before use." The present proposal to name the first variety " Tuberculin Tested " may be accepted as equivalent to the League's suggestion ; and the phrase " should be boiled before use " the League still regards as making for safety when milk which has neither been obtained from tuberculin-tested herds nor pasteurised is to be used for human food.

(6) The People's League of Health ventures to urge that the position of the Milk Supply requires legislation based on the Report of the Cattle Diseases Committee, and especially on the contention that all milk offered for human food shall attain a standard of purity and cleanliness equivalent to the present " Grade A " (now proposed " Accredited ") ; that if obtained from tuberculin-tested herds it should be so labelled, with the addition of " pasteurised " if it has been subjected to pasteurisation ; that if not obtained from tuberculin-tested herds the milk may be " pasteurised " or " sterilised " ; and that if sold without these processes " milk uncertified " is the correct lable, the phrase " should be boiled before use," being a possible addition.

(7) In speaking of pasteurisation, the League has always used this term in the sense defined by the Board of Trade, and has recognised that the process demands competent supervision. The League doubts whether this will be readily secured by the smaller municipal authorities, and hence urges that licences to pasteurise milk should be issued only on the responsibility of larger units, *e.g.*, County Councils or County Borough Councils.

(8) As illustrating and emphasising the importance of the above considerations the League begs to inform the Ministry that the People's League of Health in 1932 commenced a survey in Great Britain of raw and graded milks with the object of ascertaining to what extent the various forms were tested for tubercle bacilli and what the results of such examinations has been during 1930–1935. In reply to a questionnaire to the appropriate authorities—1,200 in all—relating to the bacteriological examination of Grade A Milk, 1930–1935, the following answers were received from the several Public Health Departments :

In 135 areas no examination of graded milks were made ; in 137 areas examinations were made but did not include Grade A milk ; in 97 areas examinations of Grade A milk were made ; in 779 areas the questionnaires remained unanswered ; and in 52 the answers were not quite precise. The total number of Grade A specimens examined was 5,274, and of these, 295 showed the presence of tubercle bacilli, *i.e.*, 5.59 per cent.

Obviously, as the circumstances otherwise are unaltered, the fact or degree of

tuberculous contamination cannot be modified by displacing the label " Grade A " in favour of the new term, " accredited." Neither the one term nor the other guarantees the safety which its face value suggests, and the People's League of Health agrees with the Cattle Diseases Committee that the proper name for milk of this quality, if not pasteurised or sterilised, is " milk (uncertified)."

(9) The League is bound to regret that the new Draft Order fails fully to recognise what seems to the League to be the supreme claim of the milk supply in reference to the public health, namely that milk offered for food should be not only clean, but also safe.

Signed on behalf of the People's League of Health.

C. O. HAWTHORNE, M.D.,
Chairman of Council.
OLGA NETHERSOLE,
Founder and Honorary Organiser.

12, Stratford Place, London, W.1.
February 26th, 1936.

REPORT ON RESEARCH WORK ON CANCER, CARRIED OUT AT THE FIELD LABORATORY, UNIVERSITY OF SHEFFIELD, 1934-1935.*

By E. MELLANBY, M.D., F.R.C.P., F.R.S.

The Dissemination of Filterable Active Agent in Cancerous and other Tissues of Fowls.

IN my report of last year I referred to experiments in which it had proved impossible to show the presence of a filter-passing agent in cancerous growths of fowls induced by dibenzanthracene and tar. This result was in opposition to those previously published by other workers in which evidence was found of an ultra-microscopic agent in chemically-induced tumours of fowls comparable to the well-known filter-passing agent of Rous and other bird tumours. I pointed out that if chemically-induced growths ever contain a filterable virus it must be exceptional and not the rule. The subject was of such great importance that further efforts were made to see whether chemically induced tumours could be propagated by a filterable agent. It seemed a matter of interest to determine whether the cancerous agent produced in a Rous sarcoma would pass to chemically-induced tumours in the same bird and, if so, whether the cancerous growths resulting from such a filterable agent would simulate the chemically-induced or the Rous sarcoma as regards metabolic activity and structure. The following experiment illustrates the manner in which this point was investigated and the results obtained. A large dibenzanthracene tumour was produced in each breast

* A Report made to the Yorkshire Council for Cancer Research on work financed by them.

of a fowl, and a cell-free extract of a Rous sarcoma was then injected into each leg, so that at the end of fourteen days the fowl had two large chemically-induced tumours in the breast and two large filterable-agent tumours in the legs. A filtrate was then made from the breast tumour tissue and inoculated into chicks. These developed large tumours, and subsequently further tumours were produced from these by means of cell-free filtrates in other chickens. Both structurally and according to metabolic tests the final tumours had the properties of a Rous and not of the original dibenzanthracene tumour. These and other similar experiments demonstrated that the filterable agent of a Rous sarcoma could pass readily into a chemically-induced sarcoma. At this stage the question arose as to whether this power of retaining the filterable cancer agent was peculiar to cancerous growth, or whether other organs apparently devoid of cancerous tissue, but in affected birds, might also contain the filterable agent.

An attempt was therefore made to see what happened to the filterable cancer agent in other tissues of tumour-bearing birds. Birds were injected with the Rous cancerous agent, and at various periods after the primary injection paper-pulp filtered extracts of different organs were made to see whether new cancerous growths could be induced from these in other birds. The organs extracted and tested in this way included the liver, the spleen, the muscle and the brain. The results of the four series of experiments so far made can be briefly described as follows :

Up to seven days after the injection of the filterable virus into the bird, no cancerous growth was produced by filtered extracts of the birds' organs. After seven days, however, it was possible to obtained cancerous growths on injecting cell-free extracts of any of the organs mentioned, the largest percentage number of takes being obtained in the case of the liver and the spleen, and the least in the case of the muscle. It would appear, then, that the cancerous filterable agent becomes widespread after the primary growth is well developed, and that from this period onwards it is unnecessary to make an extract of the tumour for purposes of propagation, but that watery extracts made from apparently normal cells of most tissues in such birds will give rise to new tumours. These results show how readily the filterable cancer agent attaches itself to the normal cells of the body, and how limited is the mechanism for producing antibodies to this agent. Further work is being carried out along these lines in order to develop the subject.

Investigation to Determine Possible Interaction Between Filterable and Chemically Induced Tumours.

Although recent research has made it abundantly clear that cancerous growths can be induced by many diverse methods, there is a widespread feeling that there is some common basis for the carcinogenic reactions produced by these different agents. In spite of the fact that efforts made in this laboratory have failed to discover any such common basis, and indeed have only emphasised differences in mode of action, the attempt to bring about simplification of the problem has continued. Last year I reported the results of some preliminary experiments

made with this object, in which mice were inoculated with Rous filterable virus throughout a period when dibenzanthracene was applied to the skin. It was thought possible that the Rous agent, although incapable of producing a cancerous reaction in mice, might in some way modify the epitheliomata produced in the skin by dibenzanthracene. The early results suggested that this was the case, and that the mice inoculated with Rous filterable agent were less prone to the cancerous effect of the chemical compound. It was thought that the early results justified further investigation on a larger scale. This has now been done. Of four groups of mice which were constantly painted with dibenzanthracene over a period of 120 days, all in one group were left untouched; in the second they were inoculated twice weekly with cell-free Rous extracts; in the third they were similarly inoculated, but with Rous extract which had been heated to kill the virus; and in a fourth group saline solution alone was injected. The results of this large-scale experiment did not justify the belief that the Rous agent had significantly modified the skin reaction to the dibenzanthracene.

The Action of Potassium Permanganate on Cancerous Tissue and Cancerous Filterable Agents.

Throughout this work I have investigated the action of various chemical substances on the metabolic activities of cancerous growths, with the object of discovering: (1) What particular metabolic activity is related to the growing power of the cancer cell; and (2) whether it is possible to find some chemical agent having a specific interfering effect on cancerous tissue while at the same time leaving the normal tissue relatively unharmed.

In the course of the past year I have continued this type of work by studying the action of potassium permanganate on cancerous activities. My attention was attracted to this subject by observing that the Rous filterable agent could easily be destroyed by potassium permanganate. If, for instance, rather stronger solutions than 1 in 10,000 of potassium permanganate are added to cell-free filtrates of a Rous sarcoma, these filtrates will not produce tumours after inoculation. Concentrations of this order have very little effect on cancer cells themselves, so that it seemed possible that if stronger potassium permanganate were added to Rous sarcomatous cells, the virus would be destroyed and the cells remain alive and on reinoculation into other fowls a type of growth might be produced which could only be propagated by cells and not by cell-free extracts. If such a condition were possible, it would be the reverse of that described in my report of 1933, in which I showed that, when acriflavine in the strength of 1 in 2,000 is added to the Rous tissue, the cells are themselves killed, but the filterable agent remains active. The above suggestions, however, were shown to be untenable because in a series of experiments in which the potassium permanganate was gradually increased until finally it was present to the extent of 1 in 200, it still remained possible to extract from the cells a filtrate which produced growth on inoculation. In other words, although the filterable agent of a Rous sarcoma when isolated from the cells is readily destroyed by weak solutions of potassium permanganate,

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when present in the cell, it is protected against much higher concentrations of this substance.

Another series of experiments with potassium permanganate was carried out to determine the effect of this substance on the metabolic activity of different types of cancer. In dilute solutions of, say, 1 in 6,000, the usual effect of potassium permanganate is to increase slightly the oxygen uptake and to diminish the lactic acid production. As the potassium permanganate is increased in concentration, the effect alters, oxidation being depressed with an increased depression of the lactic acid production.

In a previous report I mentioned that the crucial metabolic change which determined whether tumours, after chemical treatment, would grow on inoculations of cancerous tissue was the relative power of taking up oxygen, and that the glycolytic action, or the power to produce lactic acid aerobically, seemed to have but little relation to the growing power. The same kind of result is apparent in these experiments made to test the effect of permanganate. When the power to take up oxygen has been permanently lost by 50 per cent. or more, it is unusual for such tissue to produce a growth on inoculation.

A point of interest indicated by this preliminary work is that different types of tumour require different quantities of potassium permanganate to prevent them from growing. The growth most resistant to potassium permanganate so far tested is Rous sarcoma, two hours' contact at 37° C. with solutions of this salt up to a strength of 1 in 200 being insufficient to prevent subsequent growth on inoculation. Jensen sarcoma comes next, contact with the solution of 1 in 500 being usually sufficient to prevent growth on inoculation. A tar tumour of a fowl is perhaps less resistant than a Jensen sarcoma, while the tumour whose growing power is most easily destroyed is a dibenzanthracene tumour of a rat. It appears as if the effect of potassium permanganate on cancerous growths is related to what is usually described as their malignancy. Less malignant growths require the smaller concentration of potassium permanganate to prevent them from growing on inoculation. Further work, however, will be necessary before this generalisation can be regarded as certain. If it proves to be true, the applications of solutions of potassium permanganate might prove to be a useful adjunct in operative work, especially in operations on cancer of low malignancy.

Snake Venoms and Cancerous Growths.

It will be remembered that in my report of last year I described experimental work carried out to determine the effect of snake venoms on cancerous growths. I referred to the fact that in laboratory tests cobra venom in very small quantities had a powerful depressing effect on those chemical changes, namely, oxidation and glycolysis, whereby cancerous tissue got its energy for existence and growth. Other venoms, including *lachesis atrox*, *lachesis lanceolatus* and *lachesis alternatus*, were relatively inactive. I have found since the last report that Russell's viper venom, if present in about three to five times the concentration of the cobra venom, also has a depressing effect on the chemical activity of cancer tissue. I indicated

that the results were only of academic interest at this stage, because clearly a substance like cobra venom, although it might have a special action on cancerous tissue, could be of no practical importance in the treatment of cancer as long as it exerted its other deadly effects on vital organs of the animal body. It seemed desirable to continue the work and explore the possibility of retaining that action of the cobra venom which interferes with cancer activity while eliminating the action which is fatal to man or animals. It was, indeed, possible that both actions were due to the same chemical agent in the venom, and if this proved to be the case further work on these lines was clearly useless.

With the object of investigating this point we obtained from Colonel Taylor, of the Research Institute, Kasauli, to whom we are very grateful, a supply of anti-venom serum prepared by him and normally used in India as a therapeutic agent in cases of snake poisoning. I proceeded to investigate the effect of this serum on the above described action of cobra venom on cancerous tissue. The work was at first delayed by the fact that the anti-venom serum contained a small quantity of antiseptic substance which masked the experimental results. Colonel Taylor, however, kindly sent me another batch, free from antiseptic, and I proceeded to investigate its action. It was soon evident that the agent in cobra venom which exerted a toxic action on cancerous tissue was not the same substance as that responsible for death after a cobra bite, because whereas anti-venom serum antagonised to some extent the lethal effect of cobra venom, it did not prevent its toxic action on cancer tissue.

In the case of Russell's viper venom the effects were different. This substance was found to have a toxic action on cancerous tissue, but this action, unlike that of cobra venom, was prevented by anti-venom serum. It seemed at first that this inhibiting action might be specific, but control experiments showed that ordinary serum also prevented the toxic action of Daboia venom on cancerous tissue.

Further investigations are being made especially to test the action of cobra venom on the intact animal bearing cancerous growths, for the results obtained suggest that it may be possible to retain the toxic action of cobra venom on cancerous tissue and at the same time to antagonise its other more harmful effects on normal tissues by anti-venom serum.

Reviews

Thompson's Elementary Veterinary Science. By A. C. DUNCAN, B.Sc., M.R.C.V.S. Pp. viii+465. Fifth Edition. London: Bailliére, Tindall & Cox. Price 10*s.* 6*d.*

TWENTY-TWO years were allowed to elapse before an attempt to revise this popular text-book was made. The changes effected in the text by the present author do not befit the progress made during this time.

The new edition has been arranged in chapters instead of lectures, the introduction has been modified to include the actions and uses of medicines and photographs illustrating restraint and the administration of medicine. Several new diseases and a chapter on poultry diseases, consisting of six pages, have been incorporated, but too much of the old text has been copied *verbatim*. It is understood that the book is intended for agricultural students, but when one considers the high standard of instruction at our agricultural colleges and institutions, there can be little excuse for not having brought literature up to date. The treatment is sometimes archaic. Surely in these enlightened times little faith is put in a prescription of this kind as a possible cure for black quarter: "One ounce hyposulphide of soda and one ounce of charcoal, given every 6 or 8 hours in water, and 10–15 ounces of linseed oil every other day." The bacteriological nomenclature is very much out of date and the additional plate on page 253 can only add tone to the book when read by the uninitiated. The common cause of white scour in calves is still "*the* pasteurella" of 1901. In Plate XXV, the figure depicting the incisor teeth of a four-year-old horse is wrong and should have been altered or deleted; while a printer's error of the 1914 edition, namely "sudoriparous" (p. 336) instead of "sudoriferous," might have been corrected in the present one. Finally, the book contains enough of the old text to be too good for agricultural students, but it has not been sufficiently revised to be of much use to veterinary students. C. F.

Horse Facts—A Study of the Points of the Horse and Equine Mechanism. By Major A. J. R. LAMB. London: Hurst & Blackett, Ltd., 1936. Price 8*s.* 6*d.*

A VERY beautiful loose cover ensheaths this book. On it the publishers state that "This is perhaps the *most remarkable* collection of condensed facts about the horse that has ever been published" (italics are ours). They also state in the same place that "this book carries knowledge of the horse on to a higher plane than it has ever reached before." With the latter of these statements we must emphatically disagree, but we feel that probably we can entirely agree with the former. It *is* a *most* remarkable book. Just how remarkable it is, is difficult to convey to the reader of a review, but in common fairness we should perhaps seek to justify our opinions. Possibly some few examples culled at random and typical of numerous others may be of interset. On the second page of the text occurs a solemn statement that "if one half of a muscle contracts a bone will move: if the other half contracts the bone will return to where it moved from. Hence, movement." (!) A very unique and ingenious but hopelessly incorrect sketch appears in support of this statement. The whole blood vascular system is dismissed by stating that there is "one big artery" which "splits into many canals called capillaries" which "lead into veins" and so "back direct to the heart." So much for anatomy. A little further we read that the speed of movement "has nothing to do with the strength of the muscles," since "unnecessary muscle means unnecessary weight," and further that "a straight dropped hind leg is the ideal for speed." Yet a short distance further we learn that "to gallop fast . . . . a horse must have good rearing muscles." To the uninitiated, statements like this, which may be believed when read, must be *very* confusing. A very great deal of the book consists essentially of a sort of brief résumé of Haye's well-known "Points of the Horse." In most places no effort has been made to bring this up to date, so that it is really difficult to find any justification for it, except that possibly it may save the reading of the larger volume. In view of the importance of the horse in modern times it seems a pity that this book needed to have been written. The book, in effect, barely merits the trouble entailed in review. It cannot be recommended.

WM. C. M.

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Obituary

Captain A. W. N. PILLERS, F.R.C.V.S., D.V.S.M., F.R.S.E.

THE profession will read with very deep regret of the death of Captain Alfred William Noel Pillers, Chief Veterinary Officer of the Corporation of Liverpool, which took place on April 2nd, at his residence, "Hawkstone," Queen's Drive, Walton, at the early age of 53. Although Captain Pillers had been a little "out of sorts," it was only about seven weeks ago that he really gave up and became critically ill with distressing heart symptoms.

Born in 1883, Captain Pillers received his early education at Redcliffe and the Merchant Venturers' College, serving his pupilage in veterinary work at Bedminster. He entered the Royal Veterinary College as a student in 1902 and graduated in 1906, after a very distinguished career, including, amongst other honours, the Silver Medal of the Royal Agricultural Society of England, the Gold Medal of the College Medical Association and the first Fitzwygram Prize. After graduating he entered the service of the Great Central Railway. He took his Fellowship in 1911, and went to Liverpool as Assistant Veterinary Officer to Mr. T. Eaton Jones, whom he succeeded as Chief Veterinary Officer in May, 1932.

His War service, in which he was twice mentioned in despatches, was taken in France, but it is probable that he is best known in the profession for his writings on Veterinary Parasitology, on which subject he held an appointment as Lecturer in the University of Liverpool. Many members of the profession are indebted to his kindly courtesy—always given ungrudgingly and with exceptional clearness—for the recognition of specimens upon which they desired information; and at all veterinary meetings, which he attended as regularly as his time was able to permit, he was recognised as fluent speaker and an authority on whatever subject he took up.

In the year 1933 he added to his other honours the Fellowship of the Royal Society of Edinburgh.

The profession is very much the poorer by his loss, and its members will extend the deepest sympathy to his widow and two daughters.

News

WARBLE FLY (DRESSING OF CATTLE) ORDER OF 1936.

UNDER the above Order farmers are required to treat all infested cattle either (*a*) by the periodical application of a prescribed dressing, or (*b*) by removing all ripe maggots from the backs of cattle by squeezing them out, or by other mechanical means. The method of squeezing out maggots has been recommended for many years, both in this country and on the Continent, and is very effective for destroying the pest. Extensive operations were carried out in Ireland, over periods of five and six years, in which this method was exclusively employed, but no fatal results were recorded. (Report of Departmental Committee on Warble Fly Pest, Ministry of Agriculture and Fisheries. Published by H.M. Stationery Office, 1926.) An occasional fatality has, however, occurred in some countries following treatment by the squeezing-out method. These cases are attributed to a peculiarity in the system of the animal which makes it highly sensitive to the body fluids of the parasites. In the squeezing-

out process the warble maggots, especially if they are immature, may be crushed and the liberated fluids may, in rare cases, produce fatal shock. It appears that the risk involved by adopting this method is extremely small, but the Ministry of Agriculture and Fisheries wishes to point out to stockowners that they are not compelled to adopt the squeezing-out method, as the Order provides for the alternative method of treating cattle with the prescribed dressing. The treatment of cattle with the prescribed dressing does not involve the slight risk which attaches to the squeezing-out method, and is effective.

NEW CHIEF OF MEAT INSPECTION.

Edward C. Joss has been appointed Chief of the Meat Inspection Division of the Bureau of Animal Industry, U.S. Department of Agriculture, succeeding Dr. A. J. Pistor, who died several weeks ago. Dr. G. E. Totten, who has been inspector in charge of the Bureau's important meat-inspection and stock-yards station at Chicago, has been transferred to Washington ; both new appointments become effective on March 16th. The work which these two officials have to direct is one of the extensive regular activities of the Federal Government. It involves the thorough inspection of approximately 70 million head of live-stock killed for food annually in the United States, together with resulting meat food products conducted in 750 establishments in the principal cities, and requires a trained staff of about 2,500 employees.

Dr. Joss, a native of Kansas, entered the B.A.I. in 1902 as assistant inspector. Dr. Totten, a native of Illinois, entered the Bureau service in 1899 as assistant inspector.

DERMATITIS AND THE CONTROL OF ST. JOHN'S WORT.

Mr. E. Reuss, Inspector of Stock, Mudgee, expressed the opinion, based on observations in his district, that heavy stocking with black-skinned sheep is an economic means of reclaiming heavily infested areas. Ordinary white-skinned merino sheep will keep the weed (St. John's wort) in check, but they become badly infected with dermatitis, particularly about the head, as a result of photo-sensitisation. Black merinos, on the other hand, thanks to their pigmented skin, are not affected and thrive on the country.

Difficulty might be experienced in collecting sufficient black-skinned sheep, but with the co-operation of pasturalists, Mr. Reuss thinks it may be possible to obtain all the black merino lambs or sheep which are culled out from station flocks, either as a gift or at the low figure which is usually given for such sheep. Suffolk sheep, which are also black-skinned, would be immune to the effects of the plant, but the return for the wool would not be so high.

CALCIUM BORO-GLUCONATE SUCCESSFUL IN PREGNANCY DISEASE OF EWES.

Mr. John P. McLeod, Ashburton, New Zealand, writes :—" I have had a good deal to do with pregnancy disease of ewes and agree with the author of the paragraph on this subject in the January issue of *The Pastoralist's Review* (page 5) regarding the feeding and management. I cannot agree, however, with the statement that treatment is of little avail. Last spring I treated about fifty with boro-calcium gluconate (1 oz. calcium gluconate, 1½ dr. boracic and 6 oz. water) and the results were 100 per cent. successful. I inject the solution at the elbow and flank. The earlier treatment is commenced the better. Only one treatment is necessary if given in early stages of the disease.

VETERINARY SCHOOL AT BRISBANE, AUSTRALIA.

MEMBERS of the profession will read with interest that it has been decided to establish a Veterinary School, in association with the University of Queensland, at Brisbane, and that Major H. R. Seddon, of the Department of Agriculture, Veterinary Research Station, Glenfield, New South Wales, has been appointed to the Chair of Veterinary Science and will be Dean of the new Faculty. His colleagues, in this country and elsewhere, will extend to Major Seddon hearty congratulations on this high honour and will wish him every success in his new venture.

A NEW TYPE OF BUTCHERS' CATTLE.

The Union Department of Agriculture, South Africa, has recently imported two Red Aberdeen Angus bulls, specially selected, as it is intended to cross them with Afrikanders. Black colours, it is said, are not suitable for that purpose. The purpose of crossing is to obtain a quicker maturing beef type of animal.

SOUTH AMERICAN MULES FOR INDIA.

Fourteen hundred mules left Buenos Aires early this year by the steamer *Heraclides*, bound for Karachi, India, where they will be utilised for the British Army Remount Service. They were purchased in different parts of Argentina.

Personal

THE congratulations of all English-speaking veterinarians will be conveyed, this year, from both sides of the Atlantic, to two men who have helped to make veterinary history, in the persons of Professor Sir John Macfadyen, the late Principal of the London College, and Professor W. L. Williams, Emeritus Professor of Surgery and Obstetrics in the New York State Veterinary College, at Cornell University, U.S.A.

On April 20th, 1936, Sir John Macfadyen completed the 60th year of his graduation in the profession, his diploma having been taken at the Royal (Dick) Veterinary College, April 20th, 1876. On the 26th of February last, Professor W. L. Williams was entertained (on his 80th birthday) to a dinner of honour by his friends and former assistants in the Faculty of the College, where, aided by Mrs. Williams, he (quoting from our contemporary, the *Journal of the American Veterinary Medical Association*) demonstrated that he had not lost any of his skill and dexterity with the knife, by cutting the birthday cake in the approved fashion.

New Preparations

THE first volume of " Veterinary Excerpts," published by Messrs. Bayer Products, Ltd., is intended to bring before the members of the veterinary profession the uses and value of certain drugs which are specialities of this well-known firm of druggists, in a similar manner to that which is done by a brochure termed " Clinical Excerpts" published for the members of the profession of human medicine. Volume I contains amongst other things, some excellent photographs of the respective steps taken during the amputation of a dog's toe under the local anæsthetic and hæmostatic ester of novocain and cobefrin ; an article on coli-dysentery of calves, and abstracts of cases from various sources. It is a useful reminder to the practitioner of what is done by aid of drugs to the scientific methods of to-day.

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